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Carnegie-Mellon University
Software Engineering Institute

Conference Report: Overcoming the Disincentives to Modernization in the Defense Industry

William E. Hefley

March 1988

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William E. Hefley

Technology Transition Program

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, Pennsylvania 15213

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The ideas and findings in this report should not be construed as an official DoD position. It is published in the interest of scientific and technical information exchange.

Review and Approval

This report has been reviewed and is approved for publication.

FOR THE COMMANDER

SEI Joint Program Office

Karl H. Shingler
SEI Joint Program Office

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Conference Report: Overcoming the Disincentives to Modernization in the Defense Industry

Abstract: The Procurement Committee of the National Security Industrial Association held its annual winter meeting on 7-10 February 1988. The meeting was attended by more than one hundred Procurement Committee members and individuals from government and the private sector. The theme for the conference was "Overcoming the Disincentives to the Modernization in the Defense Industry." The conference addressed two questions. (1) What are the most vexing issues? (2) What actions could (must) be taken by industry and the executive and legislative branches to overcome these problems?

This conference report documents the keynote address by Mr. Thomas J. Murrin, Distinguished Service Professor in Management and Technology, Carnegie Mellon University, along with panel sessions on the topics of "Regulatory and Statutory Direction of Acquisition" and "Financial Aspects of Disincentives to Modernization."

Executive Summary

The Procurement Committee of the National Security Industrial Association (NSIA) held its annual winter meeting on 7-10 February 1988. The meeting was attended by more than one hundred Procurement Committee members and individuals from government and the private sector. Participants included corporate counsel, partners from legal firms and major accounting firms, financial and contracts management, and corporate management.

The theme for the conference was "Overcoming the Disincentives to Modernization in the Defense Industry." The conference addressed two major questions:

- What are the most vexing issues?
- What actions could (must) be taken by industry and the executive and legislative branches to overcome these problems?

This conference report documents the keynote address by Mr. Thomas J. Murrin, Distinguished Service Professor in Management and Technology, Carnegie Mellon University, along with panel sessions on "Regulatory and Statutory Direction of Acquisition" and "Financial Aspects of Disincentives to Modernization." This report does not address the subcommittee meetings held 9-10 February.

Mr. Murrin (see Appendix A) discussed two major themes. The first focused on DoD procurement policies and procedures with respect to the viability of the defense industry and the increasing price of weapons systems. The second addressed the perceived deterioration of the defense industrial base in light of our defense posture and our international competitiveness.

The first of the panel sessions addressed regulatory and statutory control of the DoD procurement system. It was noted that 127 acquisition actions have been legislated in the past four years alone. The second panel session focused on the financial aspects of these issues and their impact on

defense contractors. Neither panel developed a concise action plan for resolving these complex issues, but each provided some conclusions about the continuing impact of acquisition policies on the health of the American defense industry. Based on the data presented, it appears that any firm with an above-average set of commercial undertakings would do better in those endeavors than in the DoD marketplace. This situation was seen as a threat to the continued existence of the defense industry. This industry, however, is considered crucial to our industrial base, the economy, continued mission-readiness of the DoD, and the U.S. in general.

1. Keynote Address

Mr. Thomas J. Murrin delivered the keynote address. Mr. Murrin is presently Distinguished Service Professor in Management and Technology at Carnegie Mellon University. From 1983 until his retirement in 1987, Mr. Murrin was president of the Energy and Advanced Technology Group of the Westinghouse Electric Company. The complete text of his address can be found in Appendix A.

Speaking directly to the conference topic of overcoming disincentives to modernization in the defense industry, Mr. Murrin addressed two major themes:

1. DoD procurement policies and procedures with respect to the viability of the defense industry and the increasing price of weapons systems.
2. The perceived deterioration of the defense industrial base in light of our defense posture and our international competitiveness.

In discussing DoD procurement policies and procedures, Mr. Murrin noted that the balance between risk and reward for defense contractors is presently becoming unfavorable. Reasons for the shift in balance include increased contractor funding for internal research and development, partial company funding of development contracts, special tooling and test equipment, reduced progress payments, and increased cost disallowances. In fact, Mr. Murrin cited financial data showing that the average price-to-earnings ratio for the Standard & Poors 500 was 12.8, while the average ratio for aerospace and defense firms was only 8.2. This amounts to a discount greater than 35% based on 1988 earnings estimates.

These pressures create an impact on a contractor community already beset by ongoing program-related difficulties, such as:

- Program and budget instability.
- Micromanagement and excessive oversight (coming primarily from Congress & DoD).
- Poor public relations environment (negative perceptions by the public).

Mr. Murrin cited some encouraging signs that DoD leadership is aware of, and working on, these issues. Mr. Costello, Under Secretary of Defense (Acquisition), has been quoted as suggesting that his "could cost" concept, if used in place of the DoD "should cost," has the potential of saving up to a quarter of systems costs—costs which currently go to unnecessary paper work.

In discussing the deterioration of the United States' defense industrial base, Mr. Murrin cites a forthcoming report from the DoD. This report concludes that the industrial base of our defense effort is in serious decline. It cites many reasons for this decline, including:

- Program budget instability.
- Absence of normal market incentives.
- DoD procurement practices.
- DoD's segmented organization for acquisition management.

In addition, the report cited the following shortcomings or issues, focused on the contractor, as causes of the decline:

- American management is generally less effective than foreign firms.
- Markets are viewed solely as American markets, not world markets.
- Product requirements are viewed as "good enough," but not world class.
- Increased manufacturing insight and knowledge are needed.
- More technically trained and technically competent managers are needed.
- Boards of directors are often no longer able to properly oversee technologies and manufacturing.

Mr. Murrin went on to provide an example of a situation where attractive opportunities exist for industry and DoD to engage in cooperative, non-confrontational, win/win efforts. He believes that efforts such as this can work. The example was the Westinghouse Electronics Assembly Plant at College Station, Texas. This plant assembles complex printed wiring assemblies for radar systems such as those used in the F-16 fighter and the B-1B bomber. The plant was established under an incentivized contract from the Electronics Systems Division of the Air Force under its ManTech GET PRICE (Get Productivity Realized Through Incentivized Contractor Efficiency) program. To date, the plant has generated $100 million in savings to the Air Force and corresponding additional profit payments of $22 million to Westinghouse.

Westinghouse uses two development tracks: development of people and development of technology. Mr Murrin illustrated this with selected segments of videotapes of the College Station facility showing that it is computer intensive. In spite of the technology, College Station engineers report that their people "care about making things work—and they want to do things the right way." The videotapes concentrate on people who run the factory and the automated hardware, but they contain nothing about the complex software needed to make any one of the automated workstations perform its myriad tasks.

Westinghouse reports that the two-track approach is working. The current mean time between maintenance actions is about 100 hours for the F-16 radars—approximately 2-1/2 times the contract requirement. They report the following statistics:

- 45% cut in labor
- 40% reduction in space needed
- 55% decrease in inventory
- 70% decrease in loss of material
- 75% reduction in the manufacturing cycle

These substantial cuts have led to a reduction of investment required; and all of this has been accomplished while boosting lot yield from 15-20% up to 95%.

Mr. Murrin concluded his discussion of the example plant in College Station by pointing out that the keys to these efforts have been substantial investments in computer-integrated manufacturing (CIM), just-in-time (JIT) materials processing, automated workstations, and robotics.

Finally, Mr. Murrin discussed working relationships, such as those in College Station, where the DoD and its contractors can be in a win/win situation. In these situations, risk and reward exist for the contractor; but both the DoD and the contractor must add value to the endeavor. Mr. Murrin suggested that perhaps DoD can indeed be a catalyst, playing a role like that of MITI in Japan. He again cited the DoD study, suggesting that DoD also needs to build academic resources through a national program whose goal, for not less than five years, is to stimulate undergraduate and graduate technical programs. This effort can be viewed as building our stockpile of qualified personnel through scholarships in manufacturing engineering and industry-funded manufacturing engineering chairs.

2. Regulatory and Statutory Direction of Acquisition

The first panel session of the conference addressed the topic of regulatory and statutory direction of acquisition. This section summarizes the discussion of this panel by identifying the issues and describing the panel's conclusions.

2.1. Participants

The following participants were members of the panel:

- Dr. Allan V. Burman, Deputy Administrator, Office of Federal Procurement Policy
- Mr. Duncan Holaday, Director, DAR Council, Office of the Deputy Assistant Secretary of Defense (Procurement)
- Ms. Colleen Preston, Staff Counsel, House Armed Services Committee
- Mr. Wil Adams, Partner, McKenna, Conner & Cuneo
- Mr. Robert Manship, Director of Government Procurement Policy, UNISYS

2.2. Issues

One of the most insightful comments made by this panel was that it is very difficult to discuss substantive matters in this area because of the varied backgrounds and interests of the parties involved. Regardless of backgrounds or perspectives, the fact remains that 127 acquisition actions have been legislated in the past four years.

The panel discussed the following issues:

- Small, disadvantaged business policy.
- Defense industrial base.
- Special tooling and test equipment.
- Internal research and development cost recovery.
- Value Engineering.
- Non-developmental items.
- Role of the Office of Federal Procurement Policy.

Small Business Incentives - The House Armed Services Committee (HASC) is vigorously pursuing the issue of small, disadvantaged businesses. They have plans for hearings in Alabama, Texas, Oklahoma, and California. H.R. 1807 (proposed) has a provision that allows a small business firm to be 25% larger than normal 8A limits in complying with 8A set-aside requirements. The DAR Council is also considering changes to regulations concerning small, disadvantaged businesses. They are considering adding incentives for contractors exceeding small business subcontracting goals and exceeding those goals by more than 5%. The Council is also considering changing the small business set-aside rules. Other items under consideration are how to devote resources (perhaps through the prime contractors) in order to develop small, disadvantaged businesses. The focus here is on development and technology, as well as on joint venture arrangements.

Defense Industrial Base - HASC is not actively looking at the issue of the defense industrial base. The issue is reportedly on their minds, however. The Banking Committee is examining trade offsets and the movement of jobs out of the country, and HASC considers the ManTech and SEMATECH efforts important. During the panel discussion, questions arose about Congressional support for reverse offsets: Is Congress considering requiring a foreign company bidding on a U.S. contract to provide a U.S. offset? Some members of Congress believe that "reverse offset" is perhaps not the only alternative; but the policy has been considered as an alternative to the "Buy American" policy. The key concern is that the U.S. may not want to institutionalize offsets.

Special tooling and test equipment - The percentage of these costs that industry must pay has changed in the past several years. These cost-sharing factors continue to be unresolved.

Internal research and development costs (IR&D) - An industry working group has been looking at the issue of IR&D cost recovery. This group recently briefed the Senate Armed Services Committee. One problem, however, is that it is difficult to fund IR&D as a percentage of profit (as proposed by this group).

Value Engineering - DoD's Value Engineering Program has congressional support, but this program needs to be viable. It is currently a nightmare of paperwork.

Non-developmental items (NDI) - A panel member suggested that non-developmental items should be brought to the attention of the Defense Science Board. DoD had proposed a training program to enable program managers to make better use NDI and commercial items. The proposed program has reportedly gone nowhere in its first year. If DoD does not take action in employing NDI, its use may be mandated by Congress in the future. A participant in the panel session observed that since the commercial marketplace uses commercial terms and conditions (T&Cs), DoD should also acquire commercial goods using commercial T&Cs—not commercial goods wrapped in DoD's 44 pages of clauses, warranties, and so forth.

Office of Federal Procurement Policy - The Office of Federal Procurement Policy fills a coordinating function by reviewing legislative proposals from the Executive Branch. Its staff of about 25 attorneys, economists, and procurement policy specialists are part of President's Office of Management and Budget (OMB). They have the power to rescind regulations (through the Director of the OMB). Efforts underway include a proposal for acquisition streamlining, due out in about a month, and a government-wide policy on technical data, being prepared by direction of the President. The Office of Federal Procurement Policy (OFPP) reauthorization currently under consideration has raised several issues:

- Cost Accounting Standards (CAS) Board must be independent but is currently part of the OFPP.
- Where does the OFPP fit?
- What conflicts of interest affect the OFPP?

2.3. Conclusions

There are several perceived impediments to firms considering working in the government contracting business, especially DoD contracting. The following comments are reportedly the perception of many firms thinking about entering the government contracting business:

- Won't do it if the firm is successful elsewhere.
- Won't do it if Cost Accounting Standards applies.
- Won't do it if Truth in Negotiations Act applies.
- Won't do it if our data rights are jeopardized.
- Won't do it if the customer can terminate our contracts for convenience.
- Won't do it if only their side hears my case in the disputes process.
- Won't do it if I'm subject to their audits. (Most regulations are written for companies who do 90 to 95% of their business with the government; but these regulations are then applied equally to companies with little government business.)

Consolidation of the contractor pool, and consequently the defense industrial base, occurs because companies decide to leave the industry, and because there are mergers and acquisitions. In part, this is due to increases in the number of auditors, Inspector General staff, and ways to fall afoul of the procurement regulations (an increasing number of which are now criminal offenses).

It was reported that there is a mistaken premise applied by government personnel in the development of new procurement regulations: that recognition of allowance of costs subsequently leads to an ownership interest in the subject of that cost.

Returning to the concerns cited from the DoD Industrial Base study, panelists believe that the so-called decline of the "product" man and associated rise of the "numbers" man has not occurred just in industry. Rather, they believe that there are parallel situations occurring in government with an increase in auditors, emphasis on "would/could/should/might" cost, and the decline of program manager's and contracting officer's control of the acquisition of their programs.

3. Financial Aspects of Disincentives to Modernization

The second panel session of the conference addressed financial aspects of disincentives to modernization. This section summarizes the discussion of this panel by identifying the issues and describing the panel's conclusions.

3.1. Participants

Participants on this panel were:

- Mr. Roger N. Boyd, Partner, Cromwell and Moring
- Mr. William Murphy, Partner, Management Consulting Services, Ernst and Whinney
- Dr. Myron G. Myers, Logistics Management Institute (LMI)
- Mr. Thomas J. Murrin, Distinguished Service Professor in Management and Technology, Carnegie Mellon University
- Mr. George K. Muhlberg, Director of Government Contract Accounting Practices, Westinghouse Electric Corporation

3.2. Issues

Some of the financial issues having an impact on contractors today include:

- A Defense Logistics Agency memo placing cost-recovery ceilings on internally developed software.
- Charging IR&D expenses to the first production contract employing the results, rather than charging them as a general research and development expense.
- Mismatches between the horizontal maximization of factory resources that are possible using a good material requirements planning system and the regulations requiring vertical contract-by-contract accountability.
- Work measurement standards, believed by some to be a good example of Congressional micromanagement—imposing a 19th century philosophy and methodology which the Japanese have proved doesn't work as it contrasts with Deming's view of quality.

There is also an acknowledged administrative cost of complying with all regulations, rules, standards, and oversight and audit requirements. Of the more than 55 major requirements in the FAR/DFAR, some will be recommended for elimination or consolidation. DoD is presently working on this and coordinating its efforts with Electronics Industries Association.

Another concern is that, although prime contractors may be seriously affected, the greatest threat is that faced by the underlying industrial base of subcontractors.

An additional major concern is the defense industry's growing unattractiveness in capital markets. The industry is perceived as facing major disincentives, with needs for higher and more stable return. Contractors face a tremendous burden in acquiring sufficient working capital. There are capital needs both for modernization and for funding ongoing contracted work. Adding to these capital needs is the trend toward smaller progress payments or payment only on contract completion. The trend is reflected in the fact that publicly traded defense stocks (prior to Black Monday) had a price-to-

earnings ratio lower than that of most industrial firms. The Standard and Poors 400 ratio of most industrial firms was in the mid-teens, while the defense industry ratio was between eight and nine. Yet, the kind of massive building and upgrading that Mr. Murrin spoke of earlier requires large capital outlays.

The following data is based on Pro Forma (1986) data of $57 billion in sales for the six largest defense contractors:

- Return on sales: down from 3.2% to 2.0% (down 1.2%)
- Return on capital: down from 12.0% to 7.3% (down 4.7%)
- Long-term debt: up from $4.3 billion to $9.0 billion (up $4.7 billion)

The companies need, and are expending, capital in order to modernize; however, at the same time, there have been numerous pricing changes for negotiated contracts. These changes reduced the progress payment rate from 90% to 75% in two steps (from 90% down to 80%, and then down to 75%). In essence, a company must fund twenty-five cents of every dollar it spends on the contract, before contract completion, because the government's progress payments will only amount to 75% of the allowable expenditures. In addition, there have been changes in the percentages of special tooling and test equipment capitalization; and revised weighted guidelines (WGL) profit policies have decreased allowable profit by 1% while placing more emphasis on facilities capital than ongoing cost.

The following analysis addresses the financial impacts of these issues on one major prime contractor. This study, by LMI, was prepared for Mr. Godwin, Under Secretary of Defense (Acquisition) through Ms. Eleanor Spector's office. It has been briefed to Mrs. Spector and her staff. Mr. Godwin left office before seeing the report, and it was not known if Mr. Costello has seen it.

The figures shown are before taxes and do not consider any risks which the company was taking. During the period covered by the study (1982-83 to 1987), the external conditions changed; there were lower market interest rates (down a third) and increased contractor facilities capital (up by one half, relative to cost between 1982-83 and 1988).

The basic premise is:

Profit = negotiated contract profit + cost of money - unallowables

The model uses three measures:

- Return on sales (ROS)—profit as a percentage of sales.
- Return on assets employed (ROA)—profit as a percentage of investment in working and facilities capital.
- Internal rate of return (IRR).

Table 3-1 illustrates the major impacts on the profitability of a major prime. Decreased progress payments and profit ceilings (WGL) are the two largest factors shown. The results are sensitive to the measures used. ROS is insensitive to investment and timing, and ROA is sensitive to contractor investment. However, IRR captures both investment and timing. The results were based on an analysis of cash flows per contract by month. For purposes of comparison, an independent study by the accounting firm of Touche Ross placed the 1982-83 IRR at 29.8%.

	ROS	ROA	IRR
Under 82-3 Policies	11.8%	31.2%	30.3%
Progress Payments	-0.7	-8.6	-9.2
STTE	0.5	0.8	0.1
Profit Allowed	-0.8	-3.3	-3.4
External Conditions	0.2	-2.1	1.3
Under 1987 Policies[1]	11.0%	18.0%	19.1%

[1] Contractors investing more, primarily due to progress payments.

Table 3-1: Impacts on a Major Prime (before taxes)

The external conditions also reflect an upward trend in contractor investment. The longer the contract, the greater the impact of these changes. With shorter contracts and those with faster deliveries, the impacts are not as great.

3.3. Conclusions

These findings generally support the following set of conclusions with respect to the recent changes in acquisition and procurement policy:

- Contractors are yielding a little less profit.
- Contractors are needing much greater contractor investment to cover working capital.
- Results are approaching typical figures for an average durable goods manufacturer.

There was some discussion about whether a durable goods manufacturer is the the right standard for comparison and about the appropriate role of profit. If the goal is to attract the best firms to the contractor base, why not use the upper quartile for comparison instead of the average?

Over the time period reflected in the table, the facilities capital employed per dollar of cost (contract dollar) showed a 40% increase. There is tremendous capital investment being made. Other research contracts (cost reimbursable) have shown a greater decrease in return on sales due to the policy shift on profits. Other studies indicate a 2 to 3% decrease, instead of the 0.8% decrease shown above. Corporate returns have also been affected by shifts in contract types. In the 1982-83 time frame, approximately 75% of the contracts were fixed price and 25% cost reimbursable. Today the percentages are closer to 90% fixed price and 10% cost reimbursable.

If the three conclusions above are indeed accurate, then firms with above-average commercial undertakings will do better in the commercial marketplace than in the DoD marketplace. One of the discussants asked, "How will this industry live on the reduced profits being made today?" and responded to his own question that it cannot. But, this business is crucial to to our industrial base, the economy, the continued mission-readiness of the DoD, and the U.S. in general.

Appendix A: Text of Keynote Address

Presentation by
Thomas J. Murrin

Distinguished Service Professor
in Management and Technology
Carnegie Mellon University

to

The National Security Industrial Association
Procurement Committee's Winter 1988 Meeting

Good morning, ladies and gentlemen. I'm delighted to have this opportunity to join you at your Procurement Committee's winter meeting. I commend you for braving the rigors of Tarpon Springs and Innisbrook to attend this meeting, and I thank you for attracting me away from Pittsburgh's polar bear weather.

The theme of this meeting, "Overcoming Disincentives to Modernization in the Defense Industry," is a very timely and important one. This morning, I would like to share some thoughts with you on two of the most pressing current issues facing our defense industry, and what we might do about them. My comments will be included in a few handouts that will be available at the break.

The first issue concerns DoD procurement policies and procedures introduced during the past several years, and their serious, near-term impact on the viability of the industry. Ironically, such policies may increase–rather than decrease–the price of weapons systems in future years as contractors have to cover the costs of increased financing and risk-taking, for example.

The second issue is the deterioration of the U.S. defense industrial base, and the serious impact of this deterioration on our national defense posture; and on our nation's industrial competitiveness.

Both of these issues are appropriate for this audience, as each has strong "procurement" aspects. Like many of you, I'm very concerned about the negative impact of recent new DoD procurement policies and procedures. We're all aware of the specific problem areas, including requirements for increased contractor investments in IR&D and in development contracts, special tooling and test equipment, reduced progress payments, and increased cost disallowances, which taken together comprise a directed policy of reduced profits. These policies have thrown the business equation unfavorably out-of-balance for defense contractors. Investment requirements have been increased. Break-even points have been stretched out. And cash flow has been reduced.

Several defense industry profit studies have quantified the magnitude of the problem, including studies sponsored by the Financial Executives Institute and McDonnell Douglas. These studies predict that our nation's defense contractors could soon be in a precarious position. When current DoD policies are applied to existing industry financial data from actual programs, the results show very significant reductions in return on sales and capital, and greatly increased debt levels. For example, the McDonnell Douglas study projects that the "first wave impact" of DoD's guidelines would cut return on sales by more than a third, and return on capital by almost 40%. Debt levels would

would more than double. In addition, the study estimates that "second wave impacts" would be worse. These studies point to a defense industry headed for serious trouble in the early '90s, unless there is a concerted effort by DoD and the industry to correct these very crucial problems.

As corporate top management, boards of directors and the investor community perceive that the balance between risk and reward for defense projects has become more unfavorable, they shift financial resources to activities that do have promise of yielding adequate return. Indeed, it's their responsibility to do this. This is now happening in some companies, as we know.

The cards are already stacked against the defense industry, in that, as of January 26, the average P/E for S&P 500 stocks was 12.8, while the S&P aerospace stock group had an average P/E of 8.2, a discount of more than 35%. These multiples are based on 1988 earnings estimates.

The latest DoD disincentives to investment came at a time when many corporate top managers were already concerned about existing program-related disincentives, such as program and budget instability, micro-management and excessive oversight, and a poor public relations environment.

That's the bad news. The good news is that there are several encouraging signs that new DoD leadership is aware of the scope of these problems and is giving them much needed attention. Apparently, Secretary Carlucci and Under Secretary Costello have taken a new tack in dealing with procurement issues. As you know, Secretary Carlucci was a member of the Packard Commission, which recommended, for example, that the Pentagon's procurement apparatus could benefit from some of the efficiencies of private enterprise. The Packard Commission also recommended that the position of Under Secretary for Acquisition be created, and Bob Costello now holds this key job. We're delighted and appreciative that one of his key colleagues, Bob McCormick, planned to participate in this meeting with us.

Dr. Costello's concept of "could cost" turns around the usual DoD approach of "should cost," and suggests that weapons systems could be produced much less expensively if the procurement system were modified. He's been quoted as saying that as much as a quarter of systems costs go into satisfying largely unproductive paperwork requirements.

Other encouraging signs include provisions in the Fiscal Year 1988 Defense Authorization Bill, such as CPFF for development contracts, and coverage at 50% and higher for special tooling and test equipment.

Such good news is welcomed. But the fact remains that some of DoD's procurement policies and procedures, if fully implemented, could have devastating effects on our industry. NSIA, and AIA, and others are doing a crucial job of helping to improve the industry's situation. You are to be thanked and congratulated for this, and strongly supported in the future.

The second issue is the deterioration of the defense industrial base, another serious problem for our industry and our country. College Station is the result of an innovative, incentivized contract between Westinghouse and the Electronic Systems Division of the U.S. Air Force. Westinghouse was the first contractor to become involved in ESD's ManTech program called "GET PRICE" for "Get Productivity Realized from Incentivizing Contractor Efficiency."

The College Station concept began in the early '80s with a clean sheet of paper, a green field, and a handshake agreement between General Jim Stansbury, then head of ESD, John Orphanos, then Director of Procurement at ESD, and myself. Both the Air Force and Westinghouse took a calculated risk that, working together, we could dramatically improve process productivity and product quality. It was a risk that's paid off with, to date, over $100 million in Air Force savings and $22 million of additional profit payments to Westinghouse. Our initial goals for this plant were ambitious. We were looking for significantly higher quality and productivity and significantly lower costs and cycle times. In the planning stages, we realized how crucial the integration of technology and people would be.

This ManTech program features risks and rewards, so to win, we knew we would need nothing less than the effective use of advanced manufacturing technology, and the full and enthusiastic acceptance of this technology by our employees.

The manufacturing technology at College Station is state-of-the-art, including robots with vision and tactile sensing, computer-assisted work stations, and a comprehensive computer system to control almost every aspect of the plant's operation. We believe that College Station comes as close to being a fully computer-integrated-manufacturing facility as does any plant of its kind in the world. One of the primary reasons why this plant has succeeded is that we've created two development tracks, one for the growth of technology and another for the growth of people.

I've brought along two brief videotape segments on College Station. The first highlights the plant's advanced manufacturing technology. The second is a short excerpt from a series of unrehearsed, unscripted interviews with our people. Together, I hope they'll give you some insights into this very productive plant.

Play Technology Video Segment: 4 1/2 minutes

(LAST WORDS ON THE TAPE: "At each step in the production process, feedback terminals, equipped with bar code readers, tell the central computer system about the location and status of each board in the plant.")

But technology is only part of this success story. The other part is people. On the second videotape, you'll see an interview with one of the outstanding people on the factory team, a young manufacturing engineer. Due to time constraints this morning, we won't be able to show the entire series of interviews. But the young woman on the videotape is typical of the team's energy and enthusiasm.

Play Marie Video Segment: 45 seconds

(LAST WORDS ON THE TAPE: "I've worked with a lot of very talented people at this plant. And the thing that differentiates them from your average talented person is that they care about making things work, and they want to do things the right way.")

DoD has circulated a draft report that speaks eloquently of the problems, and suggests some comprehensive and innovative solutions. The task force that developed the report has done a super job in rigorously and systematically collecting data and information to support the contention that the industrial base of our defense effort is in serious decline. For example, the draft report states that underlying causes of competitiveness problems in the defense industrial base include program and

budget instability, the absence of normal market incentives, DoD procurement practices, and DoD's segmented organization for acquisition management.

DoD's willingness to courageously tackle this tough problem head-on is another very encouraging sign. When appropriate, wider circulation of the final report, and its consideration by the Administration and the Congress, can help to focus more attention on the scope and gravity of the declining defense industrial base problem. I hasten to point out that the DoD draft report properly highlights many other reasons for these problems, several of which relate to management shortcomings. I quote from the report:

> "Management issues were consistently identified as important causes of declining U.S. competitiveness. There was a general consensus ... that U.S. management culture and practices are less effective than those of foreign firms.
>
> Senior managers continue to view the nature of markets as national, not international, and the nature of product requirements as "good enough," not "world class."
>
> Management problems in many U.S. firms originate in the board of directors. Many board members do not know or understand manufacturing, are unable to discern technological weaknesses in managers, and have little or no technical advice available to them to assist them in overcoming these deficiencies.
>
> There are more technically trained senior managers in Japanese and German firms than in U.S. firms, and they typically are better able to understand the entire process of technology management. Commonly, they are scientists or engineers who are well-qualified to understand and manage the technologies with with they are involved."

As someone who has been significantly involved in manufacturing and management for several decades, I find these criticisms to be credible. Nevertheless, I believe that we can and must overcome such "Disincentives to Modernizing the Defense Industry." We do have some attractive opportunities, and I'd like to describe an exciting example.

I would like to relate a Westinghouse case history of how we modernized a defense operation. I offer it as evidence that cooperative, non-confrontational, win-win relationships can create value for both DoD and the contractor. I offer it as a model to be emulated, ideally to be exceeded. The example is the Westinghouse Electronics Assembly Plant at College Station, Texas. At College Station, Westinghouse assembles sophisticated printed wiring assemblies for defense electronics applications, like the radar systems for the F-16 fighter and the B-1B bomber.

What benefits has College Station generated for those involved? As stated, to date the Air Force, and ultimately the taxpayer, have saved over $100 million. The Air Force is also achieving significant operational gains for the weapons systems that use College Station's output of printed wiring assemblies. For example, for the Westinghouse-built F-16 fighter radar, the mean flight time between maintenance actions, now at about 100 hours, is about two and a half times greater than the contractual obligations. That contrasts with two to four hours for the prior generation radar used on the F-4 fighter.

Through this ManTech program, Westinghouse has forged a closer working relationship with its crucially important Air Force customer. Over the past five years, the Air Force has been both enthusiastic supporter and stern task master. The incentives built into the program have brought out the best in both contractor and customer by creating a "win-win" environment. Improved quality and productivity have brought about dramatic improvements in College Station's operations. Compared to the parent plant in Baltimore, College Station has cut space requirements by 40%, labor content by 45%, inventories by 55%, material losses by 70%, and manufacturing cycle time by 75%. Also, composite yield, the percentage of a large lot of production units that get perfectly through a multi-step process the first time, has improved from the 15 to 20% prevalent in the industry in the early 80s to a current level of about 95%.

Operational improvements of these magnitudes can lead to significant reductions in investments in buildings, equipment, work-in-process inventory and people. Decreased investment in these areas helps to counter-balance the increased investments in other parts of the business as required by DoD. A key result of all this is a dramatic reduction of cost to DoD of the output of this facility.

I should also note that the incentive profits that came back to Westinghouse as a result of College Station have helped Westinghouse make new, major investments in its defense business, including the investment of about $100 million last year, and the currently anticipated acquisition of a torpedo operation for approximately $100 million. Also, College Station is a testbed for a range of "factory of the future" technologies and techniques, including computer integrated manufacturing, advanced robotic systems and "just in time" projection planning. And it serves as a human laboratory for the team-oriented, participative management approach.

Last year, College Station was selected in a nationwide competition to be the 1987 Electronics Factory of the Year for its unique blend of advanced robotic and computer systems, its team-oriented, multi-skilled work force, and its total commitment to quality. Hopefully, this outstanding example of a ManTech program is emerging as one model for additional, more comprehensive DoD initiates to further improve working relations between DoD and contractors, and to help overcome the disincentives to modernization in the defense industry. If successful, this could significantly reduce the total cost and development time, and improve the performance and reliability of equipment and systems needed for our national security.

Let me conclude by making a link between the College Station experience and some of the content in the DoD draft report on the defense industrial base. The similarities relate to the working relationship between DoD and its contractors. Our College Station experience reaffirmed that cooperation is more effective than confrontation. That "win-win" relationships are not only possible, they can be very productive. That risk and reward can work when both sides spend their time adding value to the process. And, finally, that, when given freer reign, initiative and ingenuity can produce amazing results.

DoD's Industrial Base Study amplifies these insights. Significantly the draft report recommends that, "The DoD ManTech program should be significantly expanded through increased funding and manpower for program administration."

We encourage DoD and Congressional leadership in their efforts to improve our defense industry. DoD and Congress can be powerful catalysts for positive and productive change in our defense industry. Indeed, improving the defense industry can also benefit our country's overall industrial competitiveness. Here, DoD can also be an effective catalyst, as the Japanese Ministry of International Trade and Industry (MITI) has been in Japan. Many observers credit MITI with being the catalyst for a significant part of Japan's rapid expansion into industrial pre-eminence. Professor Chalmers Johnson, in his landmark study of MITI, noted that our nation's DoD/contractor relationship is closer to the Japanese government/industry relationship than any other segment of American industry. Professor Johnson states:

> "The relationships between government and business in the national defense industries is thought by Americans to be exceptional, whereas it was the norm for Japan's leading industrial sectors during high-speed growth.
>
> It is perhaps significant that aviation, space vehicles and atomic energy are all sectors in which the United States is preeminent, just as Japan is preeminent in steel production, shipbuilding, consumer electronics, rail transportation, synthetic fibers, watches and cameras."

In the past, DoD/industry partnerships have produced solid competitive advantages for America in electronics, numerically, controlled machine tools, and computers, to name a few. Future, productive DoD relationships can again produce competitive gains for our country. The DoD Industrial Base Study also focuses on building our country's academic resources to enhance our competitiveness. The draft report suggests that:

> "DoD should organize a national program that would be sustained for not less than five years to stimulate the enrollment and graduation in both undergraduate and graduate technical programs to assure our seedcorn of the future will meet both the quantity and quality necessary for national success."

That,

> "DoD combine a scholarship program to build university expertise in manufacturing."

And further, it suggests:

> "Industrially supported faculty positions to enable the world's best manufacturing engineers to teach future generations."

In the spirit of bringing industry, academe and government closer together in the manufacturing arena, I've recently accepted an appointment as Distinguished Service Professor in Management and Technology at Carnegie Mellon University, where I'll be very much involved with these kinds of activities. For example, at their Graduate School of Industrial Administration, we hope to introduce this fall a course on "Strategic Issues in Manufacturing," with emphasis on quality and productivity improvement. Therefore, I look forward to discussing with you how industry, academe and government can work together better.

I thank you for this opportunity, and for your kind attention. I look forward to a lively discussion on these and other issues in our upcoming panel discussions. Thank you, good luck and God bless.

Appendix B: Summary Briefing

The following briefing was presented at the SEI's weekly Information Seminar on 11 February 1988. It summarizes the key points from the NSIA Procurement Committee's 1988 Winter Meeting.

Overcoming the Disincentives to Modernization in the Defense Industry

Software Engineering Institute

Carnegie Mellon University
Pittsburgh, PA 15213

Sponsored by the U.S. Department of Defense

Context

NSIA - National Security Industrial Association

Procurement Committee - 1988 Annual Winter Meeting

(SEI is a corporate member)

Speakers

T. Murrin	Distinguished Service Professor in Management & Technology, CMU
A. Burman	Deputy Administrator, Office of Federal Procurement Policy
D. Holaday	Director, Defense Acquisitory Regulatory (DAR) Council
C. Preston	Staff Counsel, House Armed Services Committee
W. Adams	Partner, McKenna, Conner & Cuneo
R. Manship	Director of Government Procurement Policy, UNISYS
G. Muhlberg	Director, Government Contract Accounting Practices, Westinghouse
R. Boyd	Partner, Cromwell and Moring
W. Murphy	Partner, Ernst and Whinney
M. Myers	Logistics Management Institute (LMI)

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Major Themes - Murrin

Procurement policies and procedures

- Viability of the industry
- Increased price of weapons systems

Deterioration of defense industrial base

- Defense posture
- International competitiveness

Key Issues

Micromanagement and oversight

Accounting practices

Consolidation

Acquisition policy

Academic preparation

Impacts on Major Prime (before taxes)

	ROS	ROA	IRR
82-3 policies	11.8%	31.2%	30.3%
Progress payments	-0.7	-8.6	-9.2
STTE	0.5	0.8	0.1
Profit allowed	-0.8	-3.3	-3.4
External conditions	0.2	-2.1	1.3
Under 1987 policies	11.0%	18.0%	19.1%

Summary

How will this industry live on the reduced profits being made today?

- **Yielding less profit**
- **Requiring greater working capital**
- **Approaching profile of the "average" durable goods manufacturer**

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-procurement regulations

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The Procurement Committee of the National Security Industrial Association held its annual winter meeting on 7-10 February 1988. The meeting was attended by more than one hundred Procurement Committee members and individuals from government and private sectors. The theme for the conference was "Overcoming the Disincentives to Modernization in the Defense Industry." The conference addressed two questions: (1) What are the most vexing issues? (2) What actions could (must) be taken by industry and the executive and legislative branches to overcome these problems?

This conference report documents the keynote address by Mr. Thomas J. Murrin, Distinguished Service Professor in Management and Technology, Carnegie Mellon University, along with panel sessions on the topics of "Regulatory and Statutory Direction of Acaquisition" and "Financial Aspects of Disincentives to Modernization."

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